EEC140B – Principles of Device Physics II

Spring Quarter 2018

Course Description: Electrical properties, design, models and advanced concepts for MOSFET devices including scaling, non-ideal effects, threshold voltage modification (device fabrication methods). Bipolar junction transistors minority-carrier distributions, non-ideal effects and fabrication methods. Junction field effect transistor (JFETs, MESFETs), hetero-junction bipolar transistors (HBTs). Fundamentals of solar cells, photodetectors, LEDs and semiconductor lasers.

Prerequisites: EEC140A

Instructor: Prof. Weijian Yang (wejyang@ucdavis)
Office: 2160M Kemper

Textbook: *Robert F. Pierret, Semiconductor Device Fundamentals, Addison Wesley, 1996*

Computer Use: Use of Matlab is beneficial for solving some problems in the homework.

Lecture Times: Mon, Wed 4:10-5:30 pm **Discussion:** Mon, Wed 5:40-6:00 pm
Location: 216 Wellman

Teaching assistant: Roohi Ramachandran, rram@ucdavis
Yaojun Guo, yjaguo@ucdavis

Office Hours:
Weijian Yang: Wed 2:00-3:30 pm @ 2160M Kemper
Roohi Ramachandran: Tue 2-3pm, Fri 11am-noon @ 3087 Kemper
Yaojun Guo: Mon 9-10am, Thur 11am-noon @ 3087 Kemper

Canvas: Most of the information for this course will be provided on canvas, including course announcements, lecture notes, homework assignments and solutions, supplementary materials, etc. Instead of sending emails to the instructor or TA, students are encouraged to post questions and answers in Canvas. Homework solutions should not be discussed in Canvas.

Homework Box: 2131 Kemper

Homework: Homework is typically assigned on Monday, and posted on Canvas. It is due 4pm on the following Monday at 2131 Kemper Box. Late homework will not be graded. Please staple your pages, write your name, course number, and homework set number on first page. Use of Matlab is beneficial for solving some problems. Graded homework will be returned in the return box located in 2131 Kemper one week after they are due. Please pick up the graded homework within that week and ensure the grades are entered correctly in the Canvas site and inform TA if there are any discrepancies. Homework copied from others will be considered cheating. All students involved with copying will receive a no-appeal grade F for the course.

Exam: You will need to present your student ID at the exams. The examinations will be closed book. Hand calculators are allowed, but PDAs, iPhones, laptops, or portable computers, such as pocket PCs, are not allowed. Students are required to take exams at the scheduled times. Make-up exams will only be allowed

in extreme cases, such as severe illness (confirmed in writing by a physician), death in immediate family or other catastrophes. The instructor must be contacted, in advance, about missing an exam. The mid-term will cover up to the materials presented in the first four weeks of lectures. The final-exam will be comprehensive. More detailed instruction on exam will be reviewed ahead of exam.

Class project: 3~4 students will form a team and perform literature research on an advanced topic. Each student team will present their work at the lectures in the last week of the class (12 minutes presentation and 3 minutes Q&A). Each student team is also required to submit a report about their study (6~8 pages).

Re-grading: If you think you deserve more credit for submitted work, write a short note indicating what should be reconsidered, attach it to the graded material problem set or examination, and return it to the TA. The TA will review the grading. After receiving the reviewed work back, if you are still not satisfied with your score, please make an appointment to meet with the instructor at that point.

Cheating: Any student caught cheating on any exam, homework or project will receive a no-appeal grade F for the course.

Grading: letter grade based on the following

- Weekly homework: 25%
- One project: 15% [presentation 10%, report 5%]
- One midterm: 25%
- One final: 35%

Course flow:
Week 1~3: Review of semiconductor fundamentals, PN junctions, BJT and MS contact modelling and dynamics.
Week 4~5: JFET, MESFET, MOS, Midterm exam 05/02/2018
Week 5~7: MOSFET, nonideal MOS and MOSFET, modern FET structure
Week 7~9: Optoelectronics device physics, photodetector, solar cell, LED, semiconductor lasers
Week 10: Project presentation
Final exam 06/13/2018